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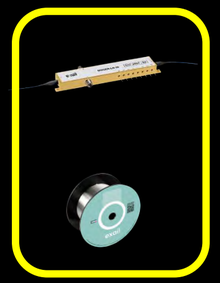
Technology provider from components to complex systems

Components

Optic



Equipment

Inertial navigation

Sonar & positioning

Quantum instruments

On-board electronic

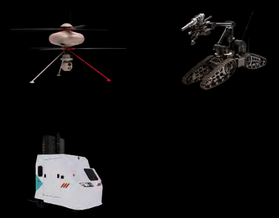
Simulators

Platforms

Surface drones

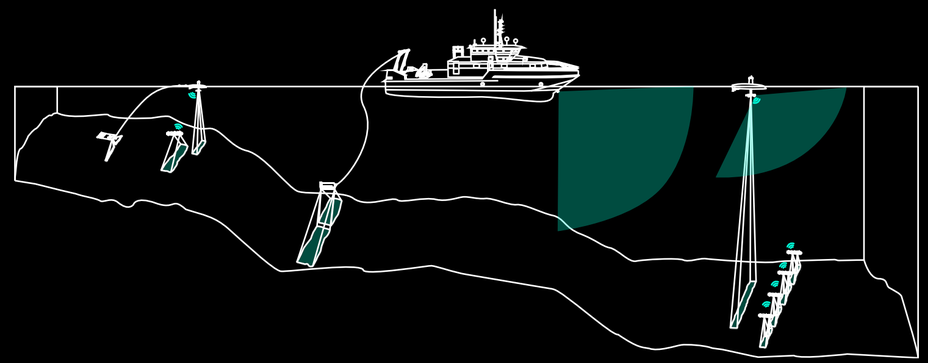
Underwater drones

Unmanned ground & aerial vehicles



Complex systems

AUTONOMOUS DRONES + CONTROL & COMMAND SYSTEM



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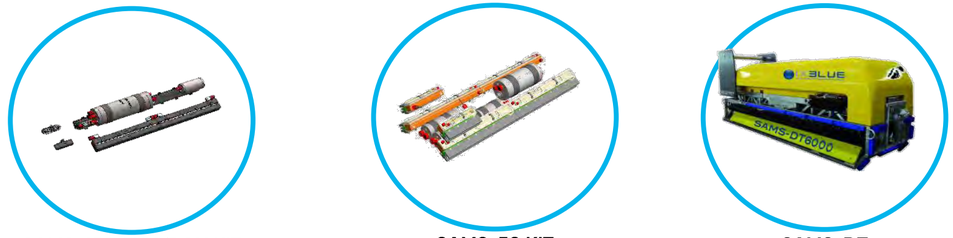
Sonar Product Portfolio

ECHOES Sub-Bottom Profiler

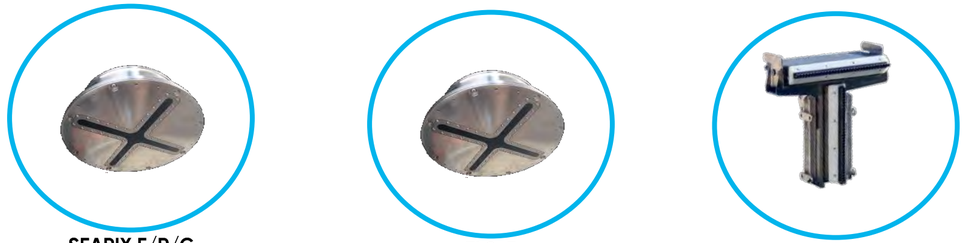
ECHOES 3500 T7/T3/T1 | ECHOES 5000 | ECHOES 10000 | ECHOES 10000 Compact

SAMS Synthetic Aperture Mapping Sonar



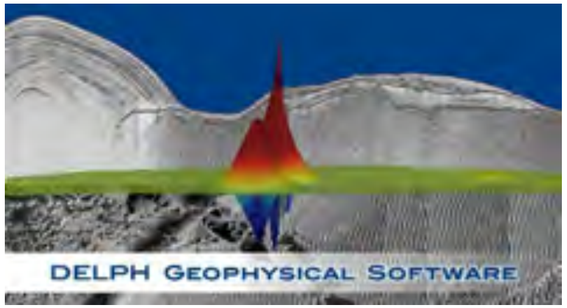
SAMS-150 AUV/ROV KIT | SAMS-50 KIT | SAMS-DT

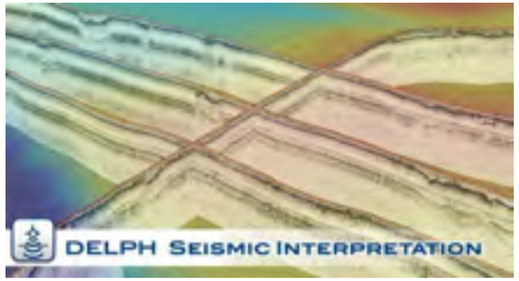
SEAPIX/FLS 3D Multi-beam Echosounders



SEAPIX F/R/C | FLS-5 | FLS-7

DELPH Software Suite





Maritime Autonomy Solutions – DriX Family

DriX H-8
Medium range USV

DriX H-9
Long range USV

DriX O-16
Transoceanic range USV

Length	7,71 m	9 m	15,75 m
Displacement	1,6 t	2,1 t	10,5 t
Endurance*	< 10 days	< 20 days	< 30 days
Speed	< 14 kts	< 13 kts	< 16 kts
Fuel capacity	250 L	550 L	2,300 L (dual hybrid propulsion)
Range	1,000 nm	2,000 nm	2,500 nm
Communications	Wifi, 4G, Satellite communication, UHF radio	Wifi, 4G, Satellite communication, UHF radio	Wifi, 4G, Satellite communication, UHF radio
Towing / launch & recovery	ROTVs towing capabilities	ROTVs towing capabilities	ROTVs, Inspection Class ROVs, 1,000 m rated AUVs
Station keeping	Hovering	Hovering	Dynamic Positioning
MBES capacity	3,000 m depth	3,000 m depth	Full ocean depth
Transportation	1x 40' High Cube container	1x 40' High Cube container	2x 40' High Cube container
Other	Launch & Recovery system		Customizable stern section for additional payload integration

* Endurance depends on speed, gondola size, towing capabilities

SEAPIX + USV DRIX – RETOUR D'EXPÉRIENCE :

TROIS LEVÉS, SUR TROIS ANNÉES SUCCESSIVES, D'ÉVALUATION DE L'IMPACT DU DÉVELOPPEMENT DES PARCS ÉOLIENS EN MER SUR LES RESSOURCES HALIEUTIQUES

Alizée Lehoux, David Barekzoy, David Vincentelli, Nicolas Buisson

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1. Context
2. Why USV
3. Instrumentation introducing SeapiX
4. First results

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CONTEXT

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Context

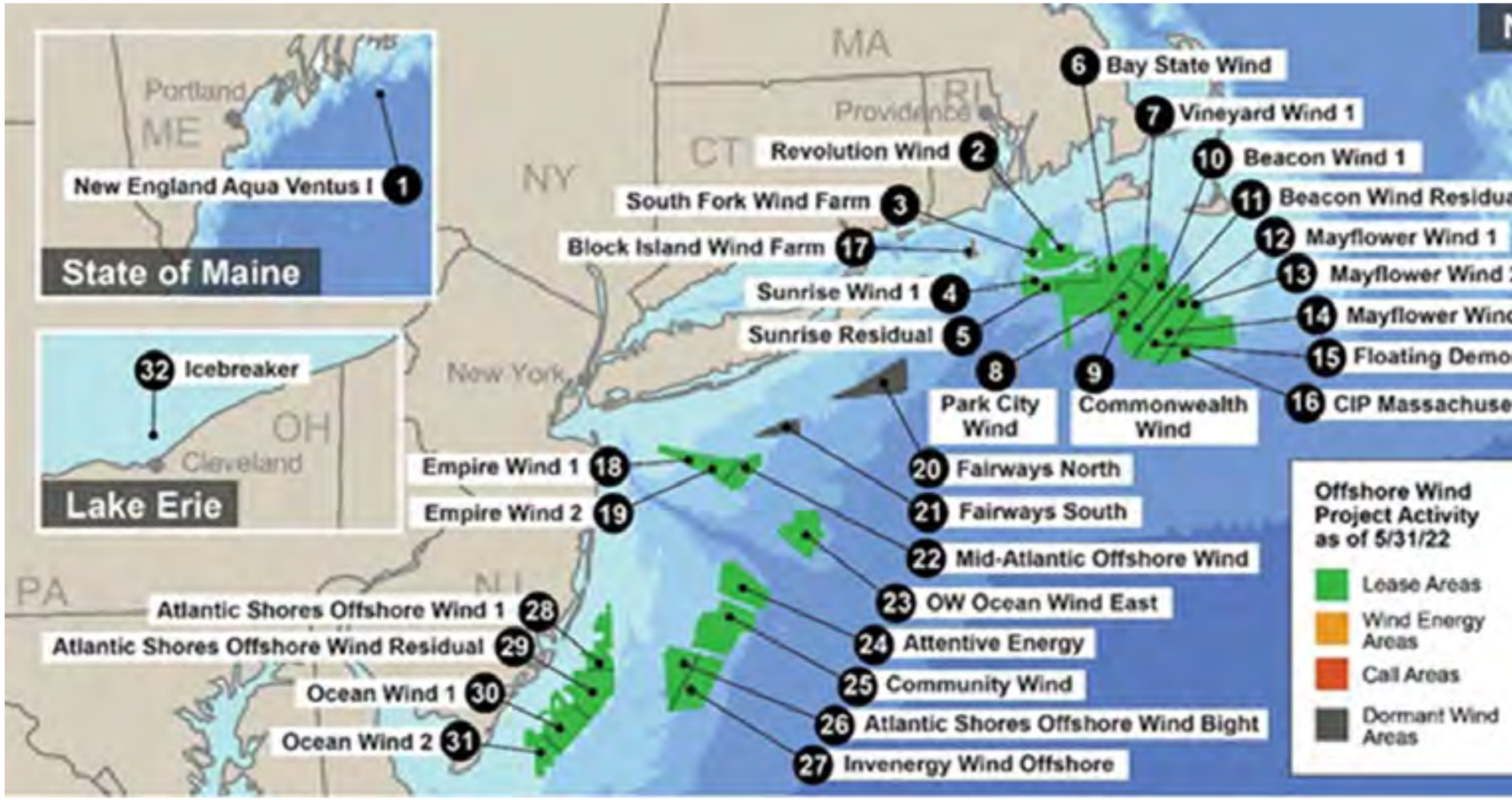
- **OWF – Protected area – whale watching etc… multiple new actors, increasing pressure on marine habitat**

Study is in particular on

- **3 wind farm areas:**
  Block Island (Orsted)
  South Fork 1 (Orsted)
  Vineyard Wind 1 (Vineyard Wind)

- **Impact of**
  - Building an OWF
  - Operating an OWF
  - Potential future decommissioning

- **Ensure continuity of measures**



In 2023

› Main focus:

Ensure continuity of measures

- Considering OWF development, to ensure the continuity of measurement
- Equiment Set-up, calibration allowing to ensure the data quality
- Experience how to operate USV
- Co-activity, Risk Assessment, Remote supervision…

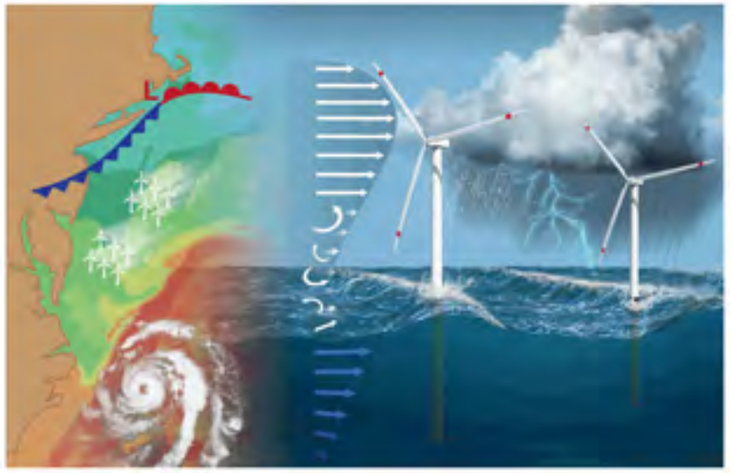
In 2025

› Main focus:

Confirm 2023 results

Commence taking full benefits of USV+ SeapiX operation

- Investigate within 30m radius of a WTG
- Benefits from SeapiX 3D Volumic MBES + EK80 multiple frequency SBES
- Example of study : Wind wake effect



Source: https://wes.copernicus.org/articles/7/2307/2022/

Source: https://windpowerplus.com

Wind wake effect: theoretical studies have demonstrated regionale large scale cascade effect of large OWF cluster on

- **Current velocity (water column)**
- **Sediment carbon distrubtion (seafloor structure)**
- **Dissolved Oxygen quantity (water column)**
- **Annual primary production (phytoplankton)**
- **Fish nursary habitat, seashell habitat, fishstock sustainability….**

Source: https://www.nature.com/articles/s43247-022-00625-0

CONTINUITY OF MEASUREMENTS
WHY DRIX ?

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Why an Unmanned Surface Vehicle for this mission ?

- 2021 - NOAA did some vessel work in the Block Island windfarm where they observed higher abundance within 100-200m of turbine structures, but there are inter-turbine differences.
- These results led NOAA to explore the utility of an uncrewed vehicle to survey offshore areas
- 2023 – Survey confirmed that manoevrability of USV was key to investigate the impact of OWF on fish stock within less than 50m from the turbine foundation
- 2025 – Researchs focus on both the very local and regional impact

Received: 1 December 2022 | Revised: 13 April 2023 | Accepted: 19 June 2023

DOI: 10.1002/mcf2.10263

THEMED ISSUE

Offshore Wind Interactions with Fish and Fisheries

Fish distribution in three dimensions around the Block Island Wind Farm as observed with conventional and volumetric echosounders

J. Michael Jech[1] | Andrew Lipsky[1] | Patrick Moran[2] | Guillaume Matte[3] | Gabriel Diaz[4]

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[2]Xblue, Denver, Colorado, USA

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Abstract

Objective: Offshore wind development is expected to expand rapidly along the East Coast of the United States within the next 10 years and will impact the biology and ecology of the flora and fauna as well as human activities, such as commercial and recreational fishing. The Block Island Wind Farm is a five-turbine, 30-MW wind array located about 6 km off the coast of Rhode Island and has been in operation since 2016.

Methods: We conducted a 4-day acoustical and biological survey of the area during daylight hours to gain insight on the spatial distribution of fish species in and around the turbines. We utilized a hull-mounted, downward-looking Simrad 38-/200-kHz EK70 and a pole-mounted iXblue SeapiX steerable Mills Cross, 150-kHz, 1.6° resolution multibeam echosounder oriented downward to map the two- and three-dimensional distributions using spiral and straight-line transect patterns. We collected fish by using hook and line to verify the sources of acoustic backscatter and to measure length, sex, and diet.

Result: Black Sea Bass *Centropristis striata* were the most commonly caught species and appeared to be the primary constituents of the fish aggregations that were mapped by the acoustic systems. We found increased levels of acoustic backscatter within 200 m of the turbine structures, suggesting that they were attractive structures.

Conclusion: These levels were not greater than backscatter levels in the surrounding area, suggesting that the proximate effect of the wind array was spatially limited.

KEYWORDS

acoustics, multibeam, offshore wind, survey methods

iXblue

Why the Drix ?

DriX Technical & Operational Excellence

- **24/7 for 22 days, over-the-horizon, *without a single weather down day***
- **Surveyed at 8+ knots**
- **Data quality:**
  - **Large payload operated simultaneously**
  - **Gondola mounted away from sea surface noise**
- **Can operate within 20m of a windturbine**
- **Co-activity : Operated alongside OCVs, OSVs and local fishermen (!!!)**
- **97% fuel savings**
  - Representing 1500L of fuel or 4To CO^2 eq
- In 2023 - 5,000+km of navigation lines (3,542km survey lines + transit)
- Operated in 30mph winds and 2.25m waves/swell significant wave height
- Detected (and avoided!) shark tracker buoys and fishing lines

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CONTINUITY OF MEASUREMENTS
WHY SEAPIX ?

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Which instruments ?

Conclusion of 2021 experimentation from NOAA Ship

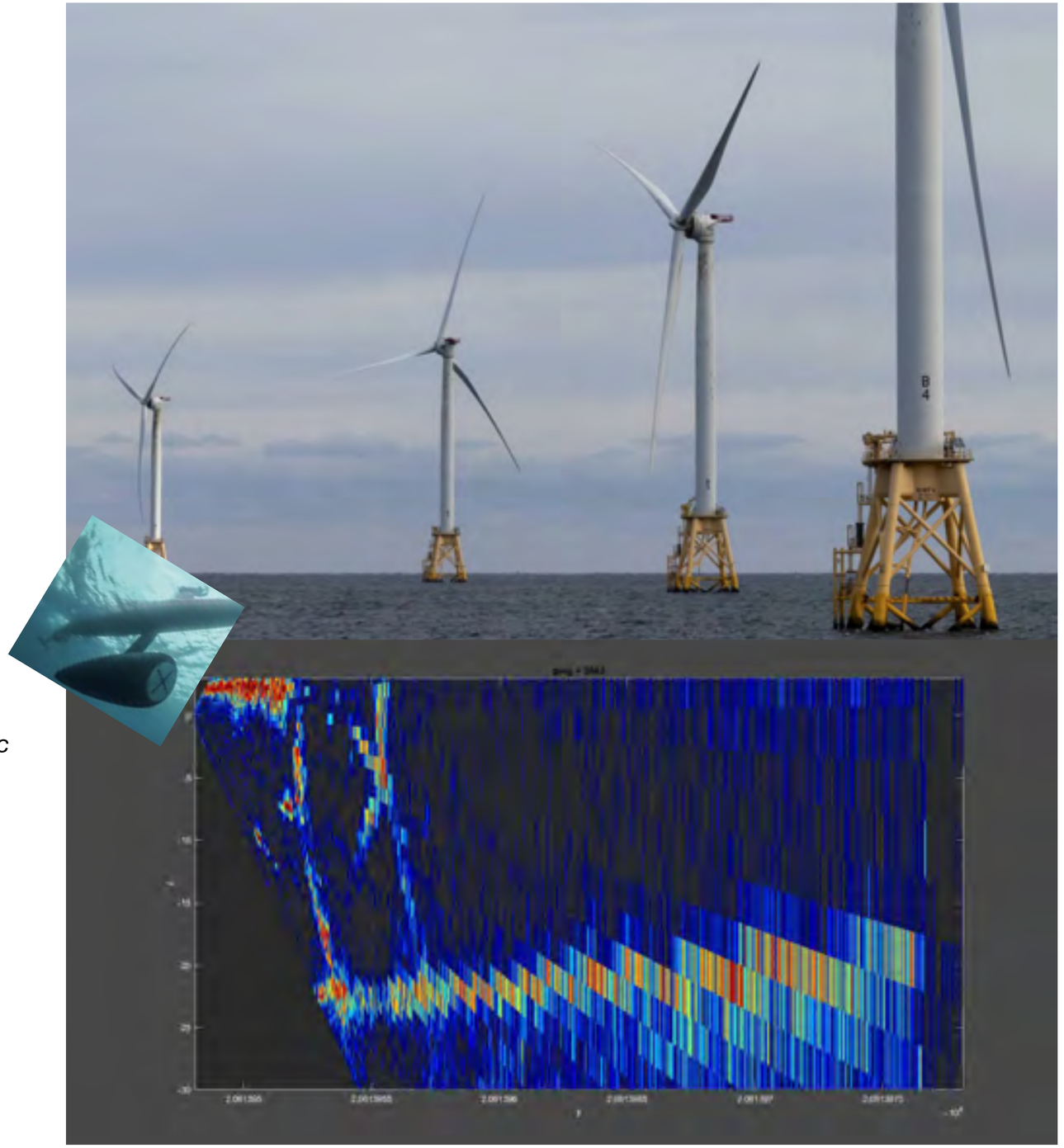
Why SEAPIX combined with conventional split-beam echosounders ?

- *"**A versatile and advanced hydroacoustic technology**. This flexibility allows it to support a wide range of scientific and operational missions in marine environments.*
- ***Standard Calibration procedures in all direction:** to ensure compatibility with conventional split-beam echosounders*

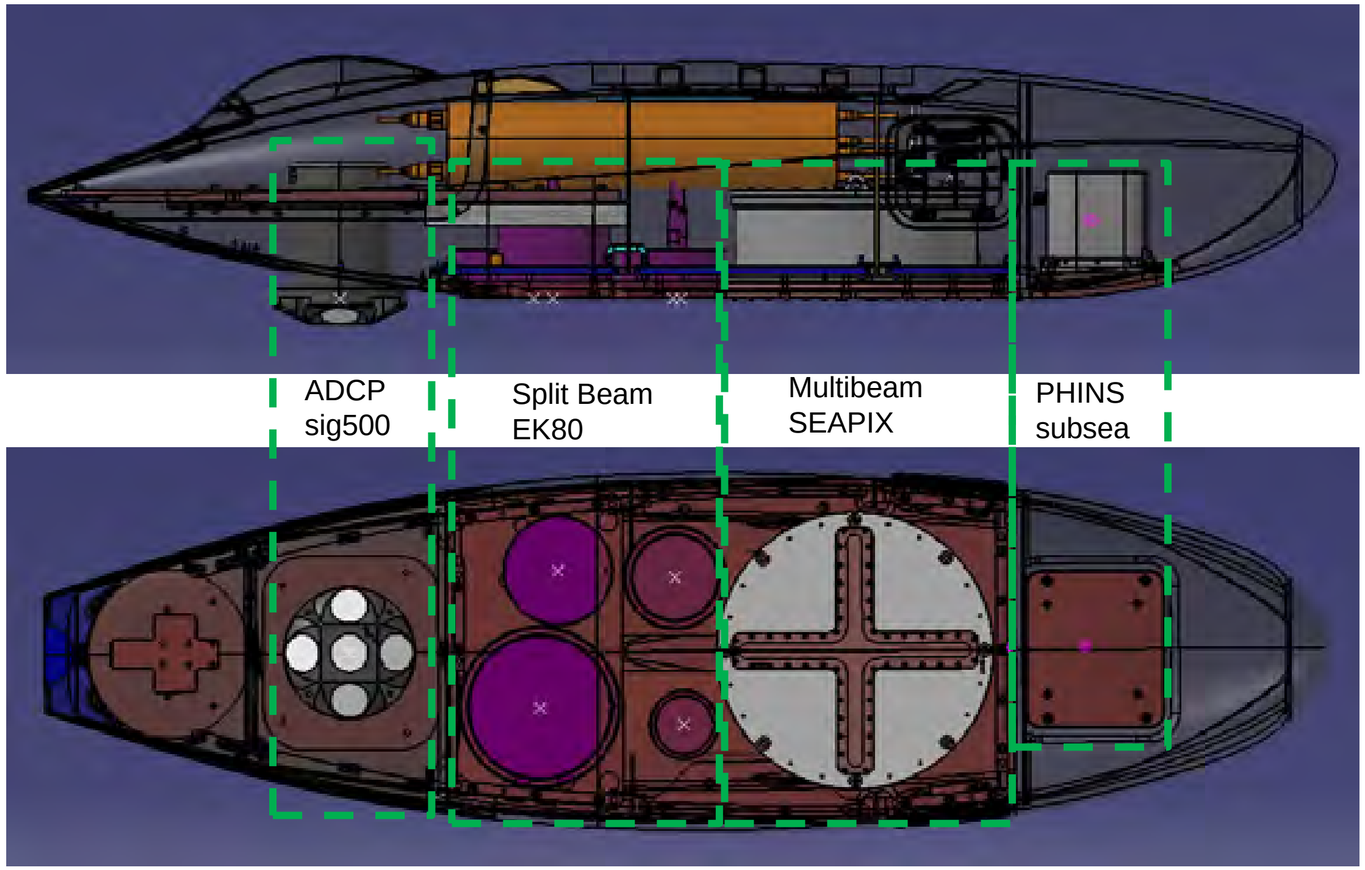
.

- ***Swath coverage and fine-scale resolution:** that enable **volumetric mapping** of fish distributions around underwater structures.*
- ***True Multibeam System:** capable of delivering high-resolution bathymetry and backscatter strength measurements.*
- *All the above ensure **continuity and comparability** between long-term hydroacoustic datasets and modern, multi-split beam SeapiX data*

- *In summary, SeapiX offers a powerful, flexible, and scientifically robust solution for modern hydroacoustic surveys, setting a new standard in environmental observation and analysis*
- *Volumetric mapping capability is particularly valuable for assessing the behavioral responses of marine life to man-made installations, such as turbines, by identifying potential aggregating or repulsive effects."*



Instrumentation 2023 - 2025



- Seapix (Exail) Multibeam Echosounder
- EK80 WBTube 38 & 120 kHz (Konsberg)
- Signature 500 ADCP (Nortek)
- INS : PHINS subsea (Exail)

- Seapix (Exail) Multibeam Echosounder
- EK80 WBTube 38, 70, 120, 200 kHz (Konsberg)
- Signature 500 ADCP (Nortek)
- INS : PHINS subsea (Exail)

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Setting to work

FIRST RESULTS

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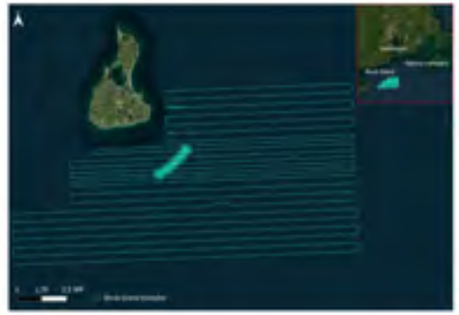
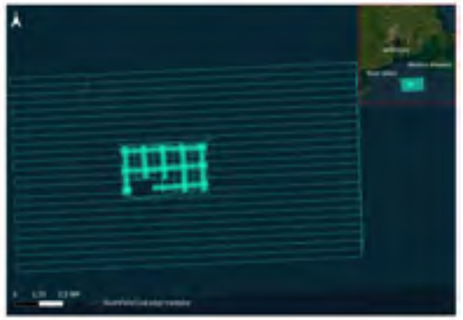
Survey summary

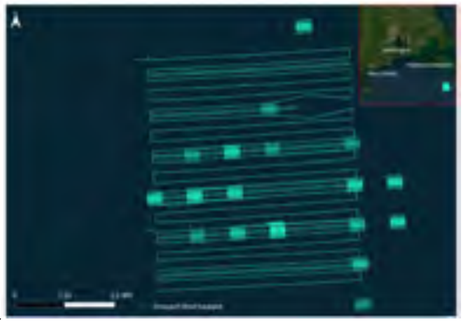
- **Line Km surveyed**

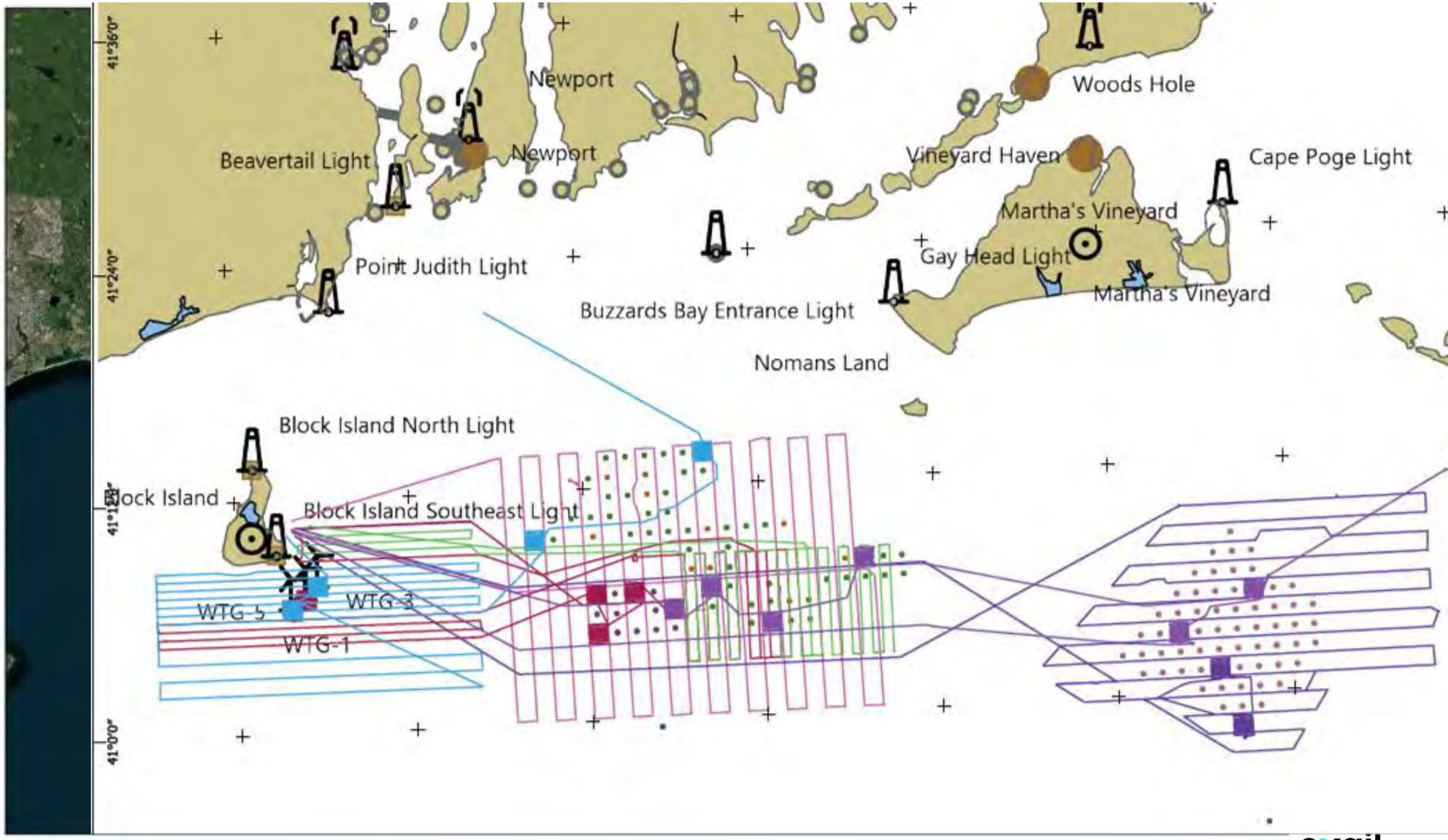
2023 - 3,542 line km

2025 – 3,108 line km



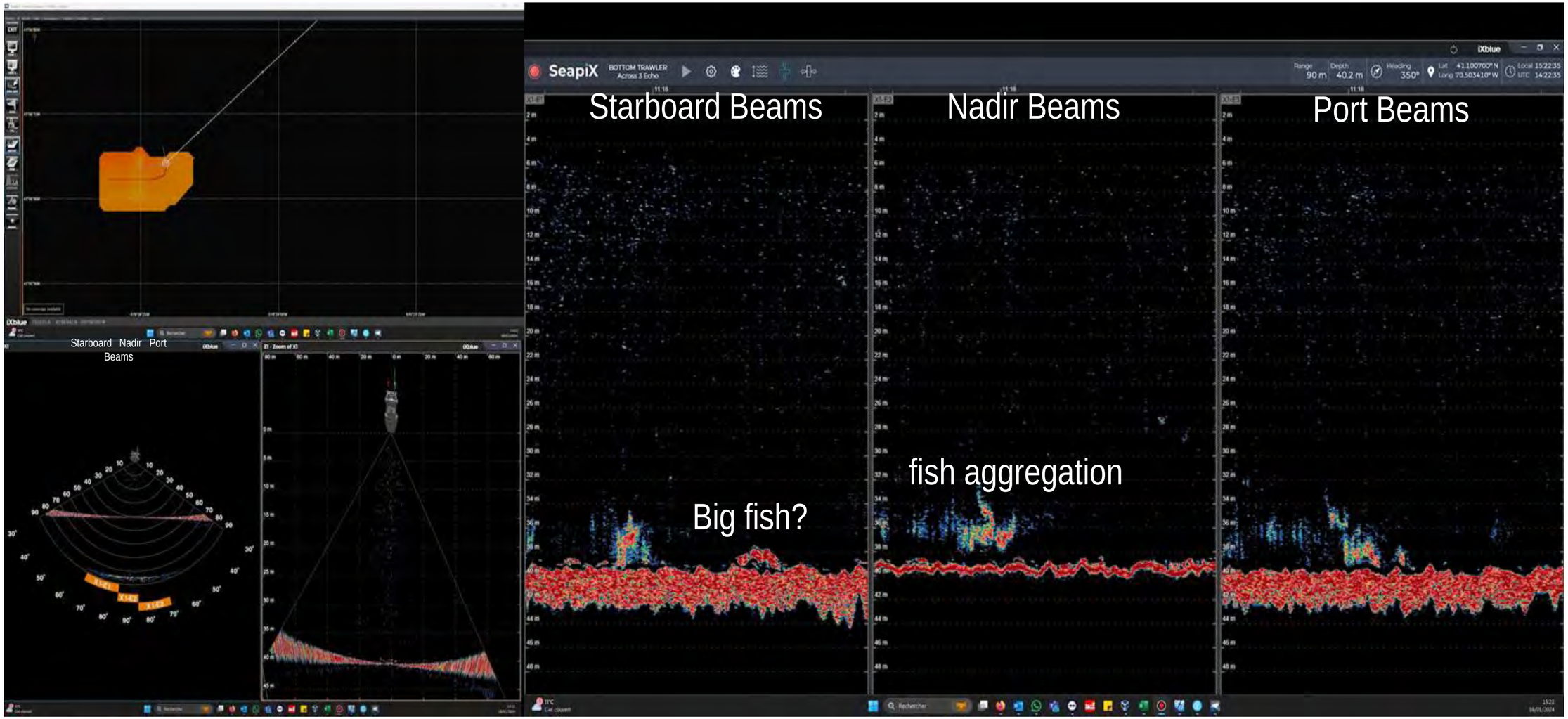






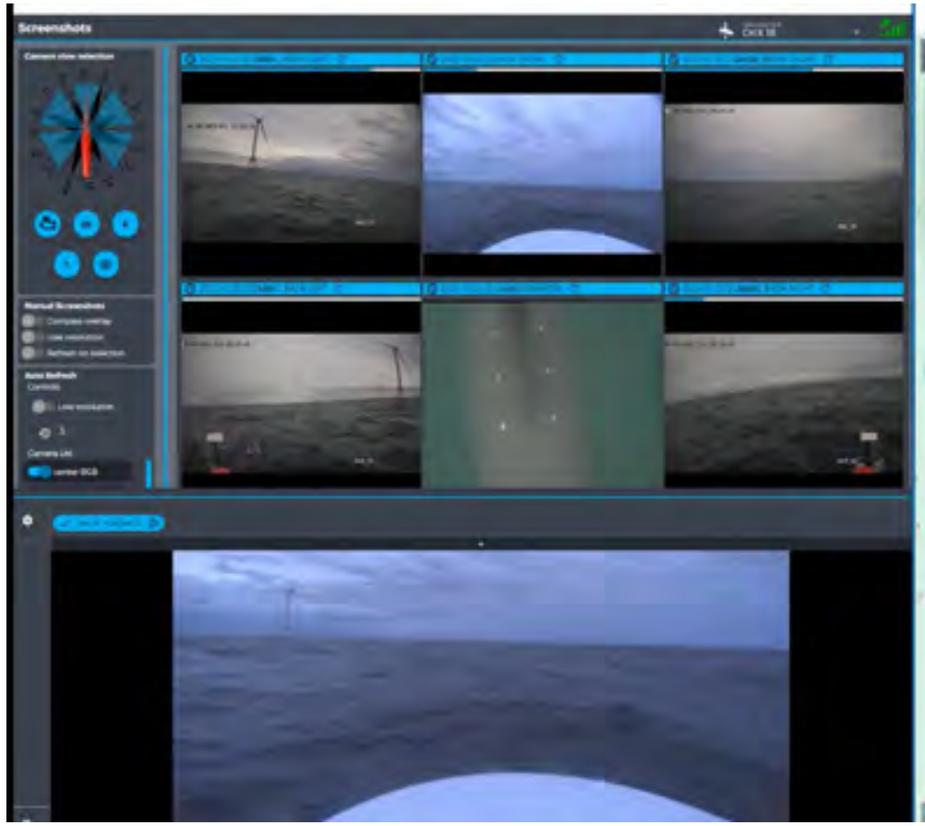
SEAPIX Water column analysis

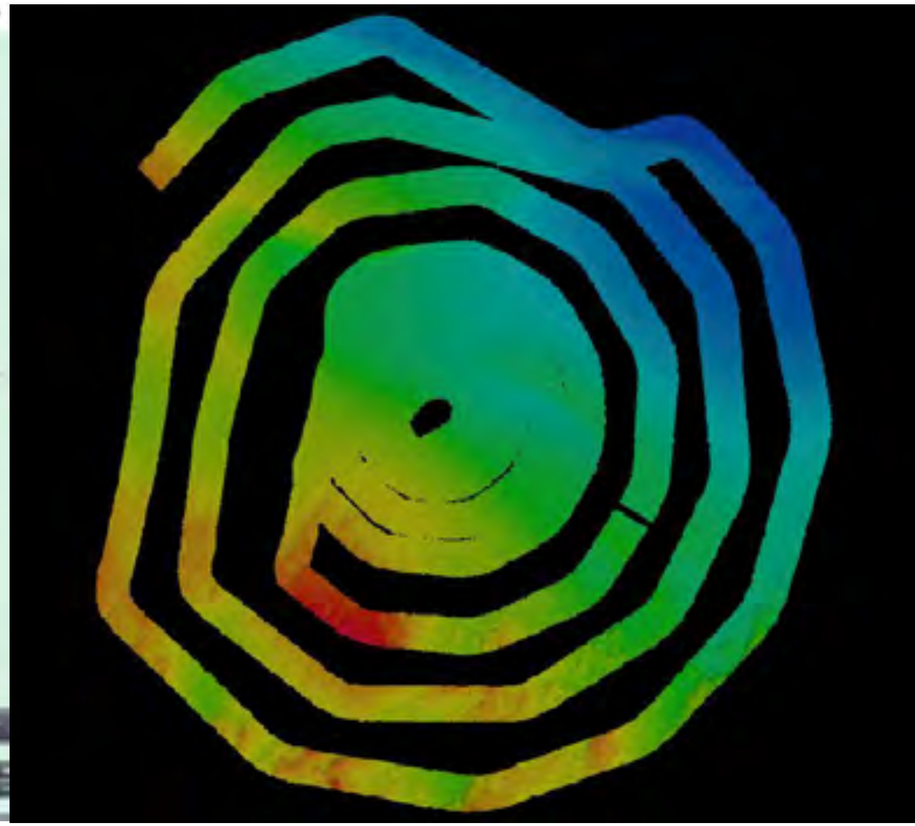
Real time



Spiral : bathymetry

- Block Island

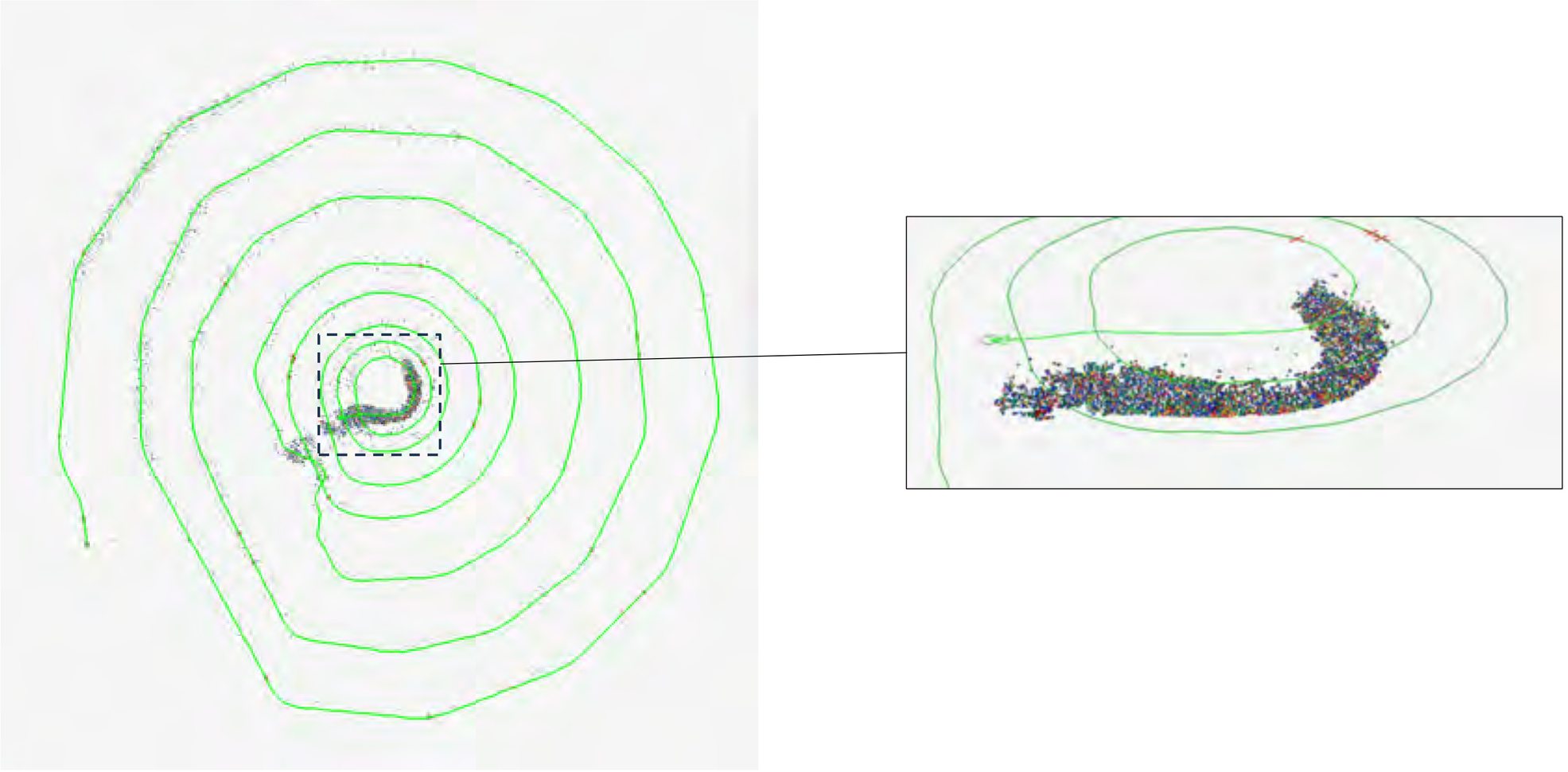




Spiral : extraction of biomass detections

Postprocessing with Echoview ®

- **Block Island**



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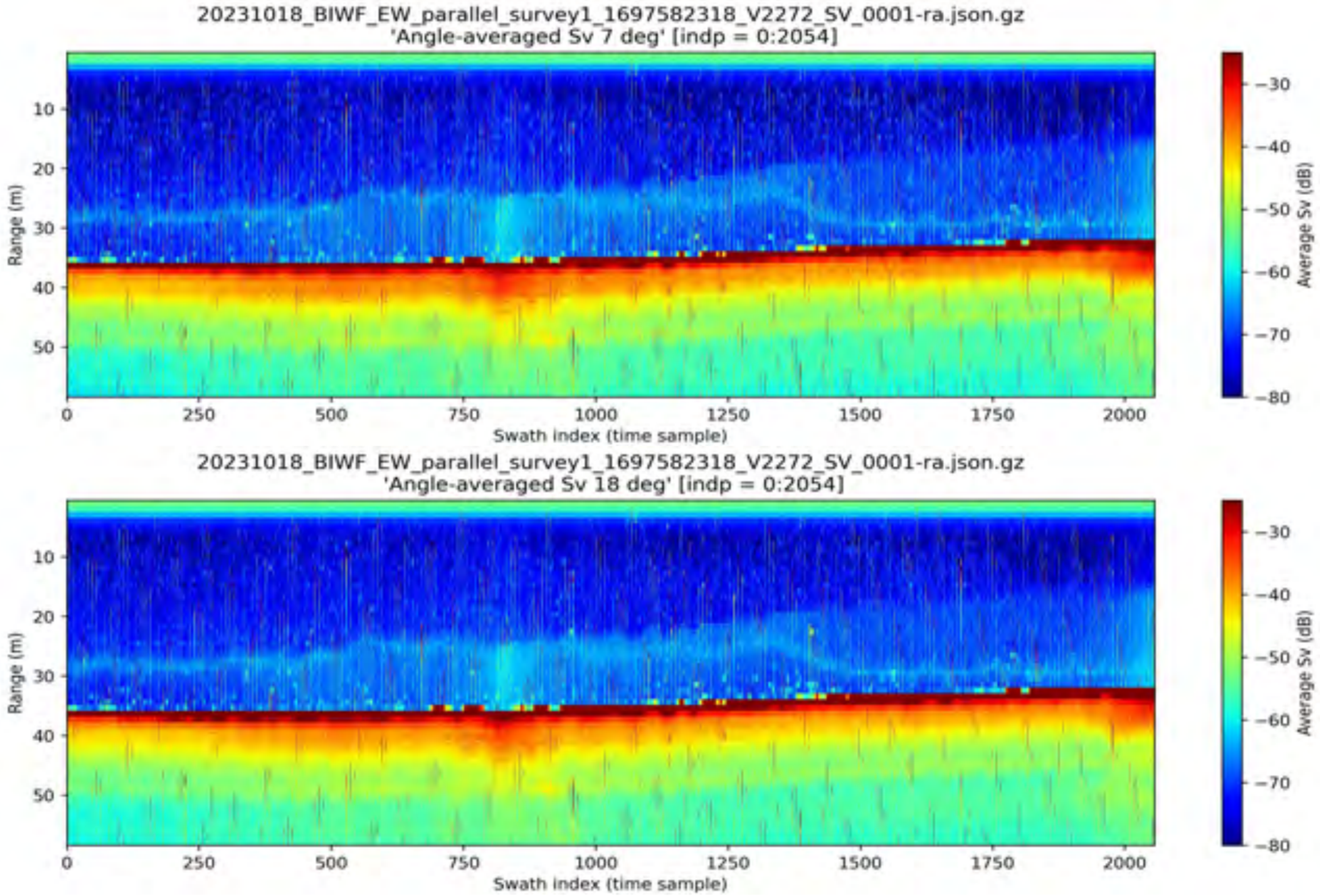
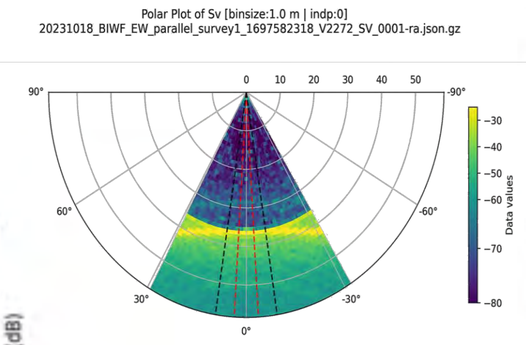
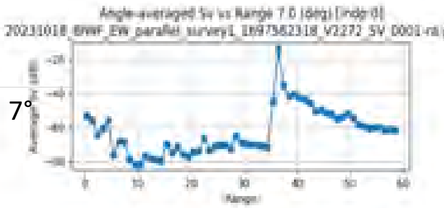
On-going studies to take benefits from all possibilities given by volumetric measures

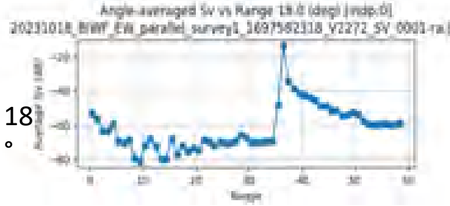




7°

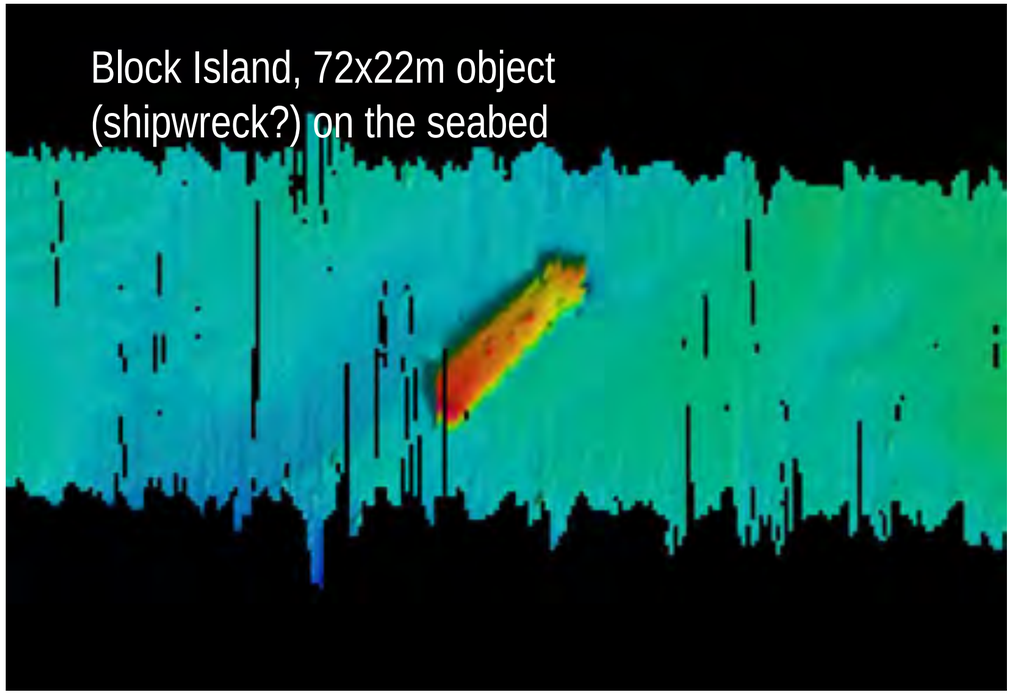


18°

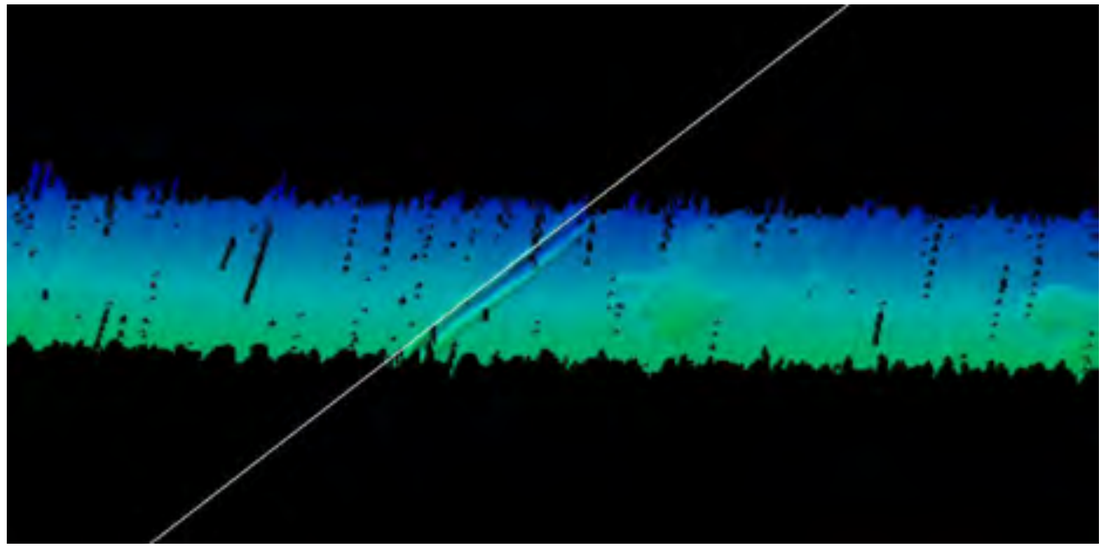


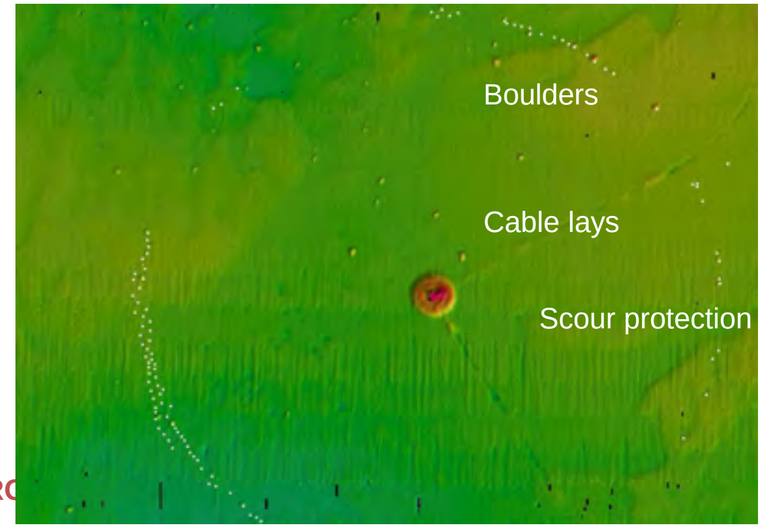
Results

- Block Island: Lying object 72 m x 22 m



- Correlation with shapefile (cable lays)





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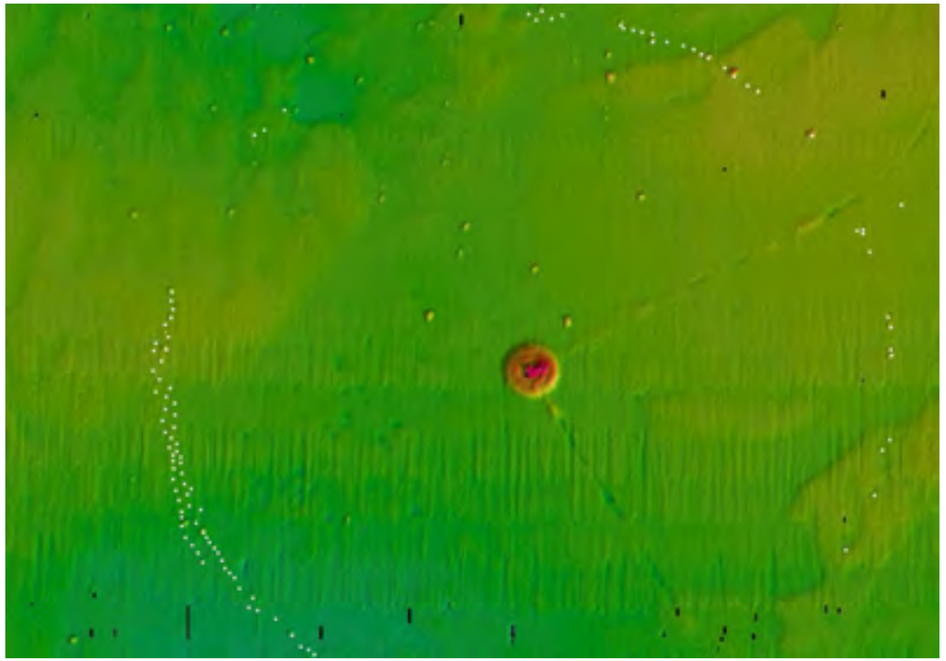
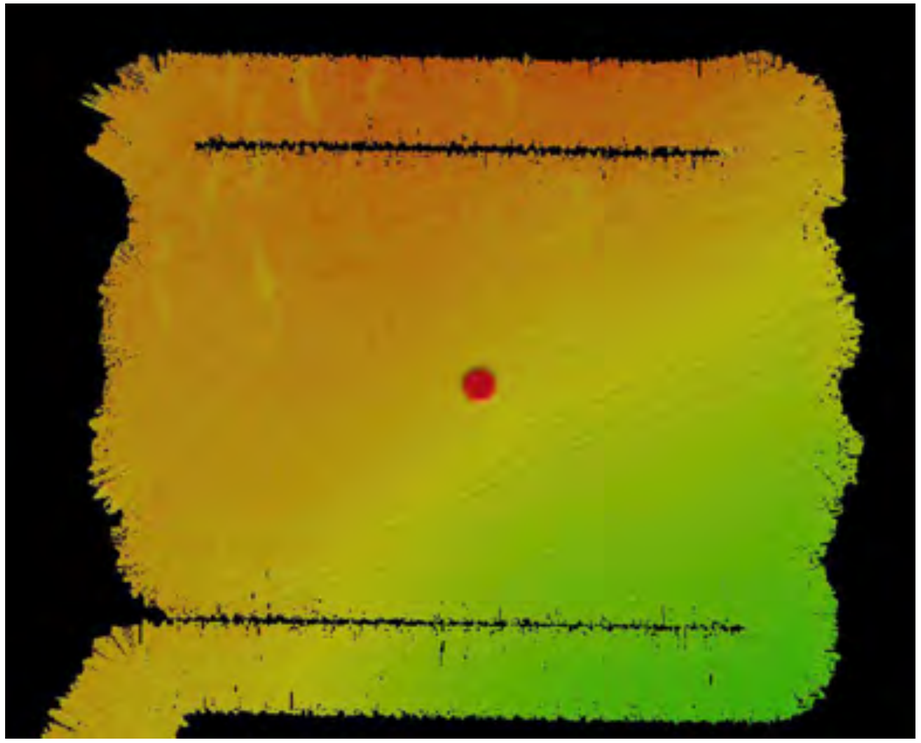
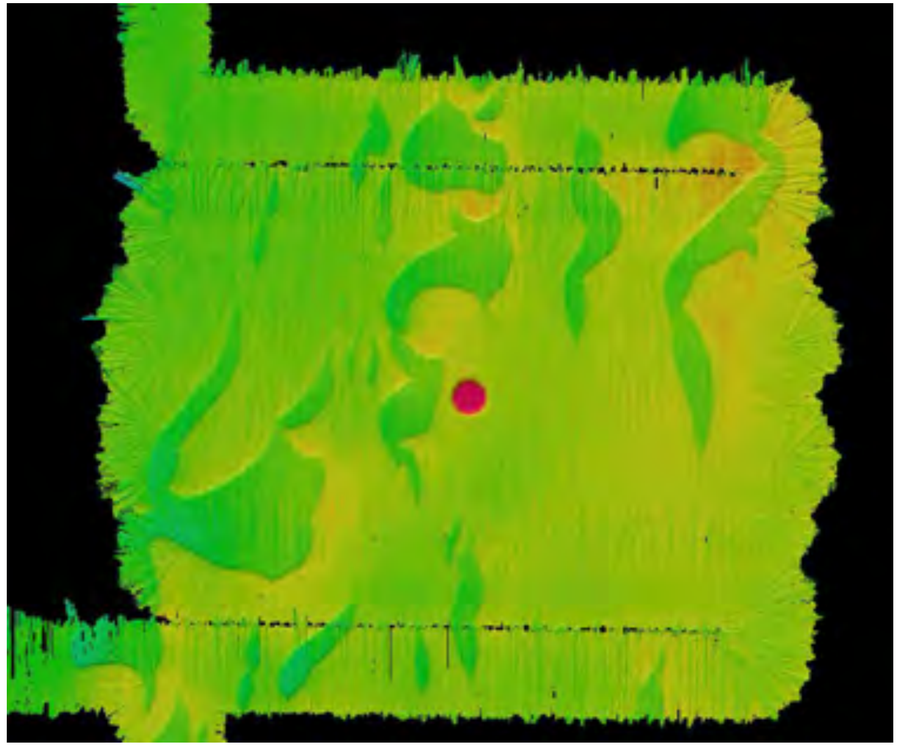
A Total Success!

SeapiX Technical & Operational Excellence



- **Simultaneous data acquisition with EK80 and ADCP**
- High quality *bathymetry* data - **validated** (fisheries data being processed by NOAA Fisheries & UNH)





- Monopiles
- Cables
- Small objects
- Boulders
- Fishing/trawl marks
- Sand displacement

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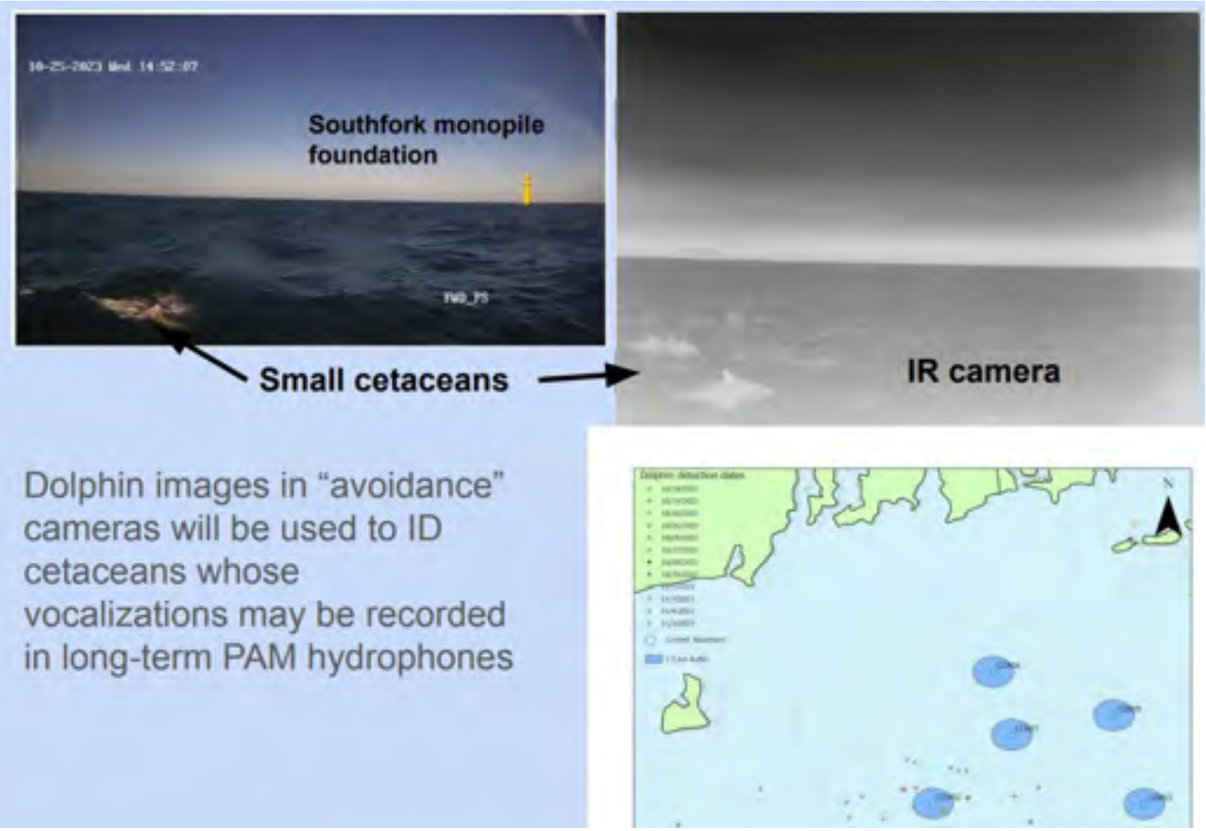
NOAA Serendipity



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Conclusions

- **Drix capable in wind energy areas-vessels and infrastructure**
- **Quality data is possible with uncrewed systems**
- **SeapiX has demonstrated complementarity and continuity with historic data**
- **Collect once use many – Environmental obs / Geophysical monitoring /Scientific study**

A TEAM WORK:
NOAA Team : Cpt. Bill Mowitt, Dexter Malley, Erica Fruh, Joshua Bergeron, Michael Jech, Randy Cutter

NEFSC Team : Andrew Lipsky, Chris Orphanides, Kathryn Ford, Lisa Mehratta
Michael Conor McManus, Peter Chase

University of Rhodes Island : Adam Soule, Christopher Knowlton, Dwight Coleman

Exail Team : Alizée Lehoux, Claire Marchand, Clement Samson, Mathieu Kerjean, Nicolas Chaplain, Olivier Moisan, Paul Dufour, Rémi Stephan, Simon Pannetier, Tehei Gauthier, Yann Gourmelen